Climatological Data for November, 1909.

DISTRICT No. 12, COLUMBIA VALLEY.

EDWARD A. BEALS, District Editor.

GENERAL CLIMATOLOGICAL CONDITIONS.

November was a very stormy month in this district; two vessels were lost on the coast, and floods did much damage to property in the interior. In the disasters at sea, 10 persons were drowned; and the heavy rains and floods caused the loss of 3 lives. The damage to property is estimated at more than a million dollars, with the railroads the principal losers, the lumbermen second, and the shipping interests third. Many farmers had their lands overflowed and fences washed away; several county bridges were damaged; a number of power plants were obliged to close their works; a few dams were seriously injured; navigation on the rivers was impeded by driftwood, and rendered hazardous on account of the swiftness of the current; mails were delayed, and the traveling public were greatly inconvenienced by washouts and mud slides.

The first damaging floods occurred early in the month in the rapidly flowing streams in western Washington, due to the heavy rains the last of October, which continued for two days in November. The floods were unimportant beyond bringing down great quantities of driftwood, and doing a small amount of damage to railroad tracks and causing the loss of a few logs. They quickly subsided, and a period of normal weather prevailed until the 10th, when the barometer began to rise, and anticyclonic conditions with temperatures below the seasonal average were the distinguishing features of the weather for several days. It was during this period that killing frosts were experienced nearly to the coast line, and the growing season over a large area west of the Cascade Mountains came to an end.

On the morning of the 17th a low-pressure area was noted off the Washington coast, and from this time nearly to the close of the month storms followed one another in quick succession. Mild temperatures prevailed during the greater portion of this stormy period and the precipitation was mostly in the form of rain, which thoroughly saturated the soil and later caused very damaging floods in many rivers and small streams.

High winds were frequent during the passage of the storms, and they were especially severe on the 18th, when a maximum velocity of 90 miles an hour from the southeast was reported at North Head, Wash., and 56 miles an hour from the south at Seattle, Wash. It was not until later, however, that the disasters at sea occurred; the steamer *Argo*, valued at $35,000, being wrecked in entering Tillamook Bay on November 25, and the British 4-masted bark *Matterhorn* foundering at sea about 75 miles southwest of Cape Flattery on November 30. Besides the loss of both vessels and their cargoes, 6 lives were lost in the *Matterhorn* disaster and 4 in the wreck of the *Argo*.

The first snow of consequence fell in the valleys between the Rocky and the Cascade mountains at the beginning of the second decade, and light falls of snow were afterwards recorded on several dates; but at the end of the month the ground was bare in nearly all the wheat-growing sections, and the snow-line in the mountains was much higher than usual.

TEMPERATURE.

The temperature averaged nearly 2° above normal over the upper half of the Columbia Valley, and it was about normal over the lower half. Nowhere, except at high elevations, was the mean temperature below the freezing point. The warmest region was along the coast, where the temperature averaged between 45° and 50°, and the coldest was at the headwaters of the Snake River in Wyoming, where the mean temperatures ranged between 28° and 31°. In the Snake River Valley, below the mouth of the Raft River, and in the Columbia Valley, between The Dalles and Wenatchee, the mean temperatures were 40° or above, being in a few localities as high as 45°.

The temperatures were above normal nearly everywhere between the 1st and the 10th, and again between the 18th and the 25th. The coldest weather prevailed between the 11th and the 16th, at which time killing frosts were general, and some ungathered fruit in Latah County, Idaho, was damaged, this being the only loss by fall frosts reported during the month. In a number of localities near the headwaters of streams in Montana and Wyoming, temperatures fell to zero, or a trifle below, but the periods with very cold weather were so short that no damage was done to the agricultural or engineering interests in the regions affected.

The highest mean temperature was 50.4° at Gold Beach, Curry County, Oreg., elevation 400 feet, and the lowest was 28.4° at Snake River, in the Yellowstone National Park, at an elevation of 7,000 feet. The highest temperature was 81° on the 3d, at Lowry in the Owyhee Basin in Idaho, and the lowest was −11°, which mark was reached at Pleasant Valley, in the Kootenai Drainage Basin in Montana, on the 14th, and at Bedford, in the Snake Valley in Wyoming, on the 28th.

PRECIPITATION.

The precipitation was above the normal in all sections, and in a number of localities it was much above the normal. That portion falling as rain was greater than usual, and in many high localities where usually a large quantity of snow falls in November, but little fell this year, and although the ground became thoroughly saturated by the rains, the lack of a foundation of early snow to slowly melt in the early summer will result in a diminished flow of late irrigation water next year unless the deficiency is overcome in other ways.

The precipitation was heaviest along the west slope of the Coast Mountains, where the amounts generally ranged between 20 and 40 inches; on the west slope of the Cascade Mountains the amounts were generally between 15 and 20 inches; and in the valleys between these two ranges the total fall ranged between 10 and 15 inches. In the sections between the Cascade and the Rocky Mountains, the monthly precipitation varied between 0.12 inch and 20 inches, being heaviest at high elevations on windward slopes and least at low elevations on leeward slopes.

The period with heaviest rainfall was from the 17th to the 24th, and precipitation was general on the 1st and 2d, and again between the 9th and the 13th. The driest portion of the month was on the 15th and 16th, when the only precipitation noted was of a local character. The heaviest monthly amount was 50.20 inches at Glenora, a station in Tillamook County, Oreg., on the west slope of the Coast Mountains; and the least monthly amount was 0.12 of an inch at Telocaset in Union County, Oreg. The greatest 24-hour fall was 6.84 inches at Happy Home, Coos County, Oreg., on the 22d, and on the same day excessive amounts were recorded in Oregon as follows:

Greenleaf, Lane County	6.82 inches.
The Heads, Curry County	6.50 inches.
Elkhorn Ranch, Coos County	6.40 inches.

Also on the 28th a fall of 6.33 inches occurred in 24 hours at Quiniault, at the base of the Olympic Mountains in northwestern Washington.

RIVER CONDITIONS.

Both the Columbia and Snake Rivers averaged between 1 and 2 feet higher than usual, but there were no floods in either

of these streams. Beginning early in the month they gradually rose, and it was not until near the closing days that their maximum stages were reached. During the last 2 or 3 days a slight fall occurred at most of the reporting stations on these two rivers.

The smaller tributaries of the big rivers, as well as those draining into Puget Sound and the Pacific Ocean, rose rapidly early in the month, and in western Washington unimportant floods occurred. This high water was of short duration, but the preceding rains had thoroughly saturated the soil and the normal rainfall that followed was sufficient to keep all streams at higher stages than usual until the event of the heavy rains between the 17th and the 24th, which caused a second rise that proved to be the most damaging one of the season.

The Nooksack, Skagit, Stillaguamish, Snohomish, White, Green, Nesquali, Chehalis, Cowlitz, and Lewis rivers in Washington, and the Deschutes, Willamette, Wilson, Yaquina, and Coquille rivers in Oregon, all overflowed and did great damage along their courses, especially in the bottom lands near their mouths. No records are available showing the past or present stages of any of these rivers except the Willamette, and a special report covering the flood in that stream has been prepared. The floods in the Nooksack, Chehalis, and Deschutes rivers were reported to be the highest known by the inhabitants living in those valleys. The damage done was enormous, and 3 deaths can be traced to the effects of the heavy rains and resulting floods; 2 were locomotive engineers who ran into slides and lost their lives in the wrecks of their engines, and 1 was a young man who slipped from a hastily constructed raft he was using to get from his house to the barn for the purpose of feeding some stock; he was drowned in the swift current before bystanders could rescue him.

The greatest damage was done to the railroads by washouts and slides, and it was several days before trains were able to run on some of the divisions of the Great Northern Railway, and in many places traffic on the Northern Pacific Railway was interrupted for short periods. Quantities of logs broke from their fastenings and were carried away by the swift current, some of which were afterwards recovered at great expense, and some were carried to sea where they became a menace to navigation along the coast between Cape Flattery and Cape Blanco. The damage to bridges along the Deschutes River was especially heavy, due to the fact that the stream had the reputation of having a very uniform discharge and the necessary precautionary measures were not taken in building the approaches, and fastening the ends of the bridges to them. Almost every industry was affected, either directly or indirectly, and the estimated damage of a million dollars is a very conservative one.

The warnings issued by the Weather Bureau were accurate and timely and, in the case of the Willamette Valley flood, were the means of saving thousands of dollars worth of property. The shipping interests were also benefited by the warnings to an unknown extent, a partial realization of which may be inferred from the fact that the principal losses were to vessels at sea, and the captains of those within reach of information were enabled to protect their vessels from being seriously injured.

IRRIGATION IN IDAHO.

The work of gathering precipitation data from the headwaters of the various streams in Idaho is one of great importance, for the reason that irrigation development is proceeding with greater rapidity in this section than in almost any other part of the country. Already the Snake River furnishes water to irrigate more land than any other stream in the United States, and every season sees large areas reclaimed in the valleys of the Snake and its tributaries. In planning the works for these irrigation projects the engineers are guided largely by the Weather Bureau reports of precipitation. Unfortunately, in many of the smaller drainage areas, data relative to precipitation are either entirely wanting or so fragmentary as to be of doubtful value. The plan adopted in 1908 for establishing, equipping, and maintaining mountain snowfall stations would do much to overcome this difficulty, if funds were available to carry it out. In this State, however, the work is at a standstill owing to lack of funds.

IRRIGATION IN ROGUE RIVER VALLEY, OREGON.

The Rogue River Reservoir and Irrigation Company is constructing an irrigation system that will irrigate 45,000 acres of fruit land in the heart of the Rogue River Valley. The source of water supply is Little Butte Creek, a tributary of Rogue River. The supply from the natural flow of the creek will be supplemented by "stored" water to be drawn from Fish Lake and Four Mile Lake, whose combined storage capacity of 35,000 acre-feet is being developed by the construction of low rock-fill dams at their outlets. The main canal after leaving Little Butte Creek encircles the entire valley surrounding the city of Medford, and in a length of 65 miles supplies practically all of the valuable fruit land of that section. The cost of the project is estimated to be $1,250,000 and construction is to commence March 1, 1910.

The company owns 7,000 acres of land which will be put under irrigation, partially improved, and sold in small tracts.

The development of this project is of peculiar interest because it marks the adoption of irrigation on an extensive scale in western Oregon, where the climatic conditions are semi-humid in character, and where up to the present time all agriculture has depended upon the natural rainfall alone. The rainfall in this section averages 24 inches annually; but of this amount, only about 10 per cent comes during the crop-growing season.

POWER IN THE COLUMBIA AND SACRAMENTO RIVERS.

Mr. M. O. Leighton, of the U. S. Geological Survey, states in a recent article that the power possibilities in the basins of the Columbia and Sacramento rivers are about one-third of those of the whole United States. He estimates the minimum horse-power available in these valleys to be 12,979,700, with an assumed maximum development of 24,701,000.

FLORES LAKE, OREGON.

Articles of incorporation for the Pacific City Canal Company were recently filed at Salem, Oreg. This company proposes to connect Flores Lake with the Pacific Ocean by a deep-water lock canal. Flores Lake is a body of fresh water in Curry County, Oreg., which is said to have an average depth of 40 feet. The plans of the company comprehend the immediate completion of the canal and also the construction of 50 miles of railroad to connect the harbor with interior points. The surrounding country is thickly forested and there are coal mines only 8 miles from the harbor which it is believed can be profitably worked.

McKENZIE RIVER.

Mr. J. L. Lambirth, manager of the Northwestern Corporation, announces in the press that his company will soon begin the construction of a dam 45 feet in height across the McKenzie River, near Martins Rapids. When completed the plant will have a capacity of 15,000 horsepower, and will cost in the neighborhood of a million dollars. The power generated will be used at Springfield, Eugene, Irving, Junction City, Harrisburg, and Albany, Oreg.

THE DALLES-CELILO CANAL.

In the specifications for The Dalles-Celilo Canal, the U. S. Engineers have incorporated under the head of "Working season" an item regarding the average weather conditions at The Dalles, Oreg., which shows one of the advantages to be obtained from a well-kept weather record. The Dalles-Celilo Canal will cost a million or more dollars and the knowledge gained by the weather record, which has been kept for over 30

years, will enable the contractors not only to estimate more closely on the job, but the successful bidder will be able to plan to utilize the unfavorable season for the assembling of material and the favorable season for pushing the work of actual construction.

Freshets at The Dalles, Oreg.

The annual freshet which occurs about April 15 and ends about the middle of August will cause a suspension of active work for a period of about 4 months, though some of the work on the higher levels can probably be carried on during a portion of the freshet season.

During the winter months occasional freshets occur, due to the fall rains, which might interfere with the work on the lower levels. Ice gorges occur, rarely, in January and February.

The summer and winter freshets, and snow and ice, cover a period of a little over 4 months. The remainder of the year is generally favorable for construction work.

The U. S. Weather Bureau records at The Dalles, covering a period of 34 years to January, 1909, show that on an average the thermometer reaches or falls below 32° on 74 days of each year, and that the average temperatures for the months of January, February, and December are 32.4°, 34.0°, and 36.1°, respectively. The mean annual precipitation for 34 years is 14.17 inches. In the last 13 years running ice has occurred 6 times in January and 3 times in February.

CAPACITY OF SPILLWAYS.

Messrs. Whistler & Stubblefield, hydraulic engineers, of Portland, Oreg., in referring to some recent very high waters in the Columbia Valley, state they illustrate the necessity of providing ample spillway capacity in the construction of dams, on which subject they further remark as follows:

It is unsafe to provide only for the largest flood known, even though observations on the behavior of the river cover a long period. To provide capacity for double the largest flood known within the last 20 or 30 years is, in some cases, entirely too small. The flood in the Deschutes River at Bend, Oreg., in November, for example, reached a height that gave twice as large a discharge as any previous flood so far as can be determined from the records, or from information furnished by the early settlers.

Another instance of a flood that could not have been foreseen from records, or from information obtained from early settlers, is the one that occurred in 1907 down Cold Spring Canyon, which canyon is now known as Cold Spring Reservoir on the Government Irrigation Project in Umatilla County, Oreg. A flood of more than 5,000 cubic feet per second washed out three-quarters of a mile of the Oregon Railroad and Navigation Company's track at Cold Spring siding that year. No flow from this canyon had reached the track since the construction of the railroad about 25 years before, and no opening whatever had been provided. The only way in which such a flood could have been foreseen would be to take into consideration the area drained, and allow for extremely unusual weather conditions.

HYDROGRAPHY OF THE SOUTH PALOUSE RIVER, WASH.

By HANS MUNN, jr., Civil Engineer.

THE VALUE OF HYDROGRAPHY.

One of the greatest resources of the United States lies in the running water. The first in time, if not in importance, of the objects of hydrography is undoubtedly that pertaining to navigation. This part of hydrography may almost be considered at an end, requiring for the most part merely the continual revision necessitated by some changing conditions due to erosive or artificial clearing of some of the important streams.

Next we have the demands for information concerning the water that, through its velocity and change from higher to lower levels, furnishes power for so much of our machinery. If the streams continued to flow unvaryingly through the different seasons of the year it would be a very easy matter to ascertain the power that would be relied upon but, with their constant fluctuations day by day, it becomes a problem taking years of measuring to determine the power available through all the seasons of the year. At certain seasons the amount of water may be greatly in excess of any possible utilization, and then again there comes a season during which the quantity drops below that required for the water wheel, and the storage of flood waters must be resorted to.

In the United States there has arisen a third demand for knowledge of the water resources, which in political and social importance ranks even above the needs of navigation and manufacturing. This is through the extension and higher development of agriculture by the artificial application of water. One-third of the total area of the nation is still at the disposal of Congress, and this one-third includes some of the most fertile areas of the Continent. It is, however, practically unavailable to the settler, usually a man of small means, because of the fact that the climate prevailing through the vast extent of this public land is too arid to allow the growth of ordinary farm crops. Irrigation must be practised and where it has been employed so far it has been very notably successful; but the supply of water is scanty and in many cases before an acre of the best land can be cultivated an enormous expenditure must be made in the construction of reservoirs, canals, and ditches. Lately the Government has undertaken the work to build large reservoirs, construct canals and ditches, and thus in every way make possible the utilization of the vast extent of arid land. Before plans involving the utilization of these lands can be made it is necessary, however, to obtain accurate knowledge as to the available water supply both above and below the ground, and of the possibilities concerning floods and of raising water by machinery from lower to higher levels. With the fluctuations which take place from year to year, it is obvious that such investigations must be continued for periods sufficiently long to show the ordinary range of conditions.

There is yet another series of investigations which, though individually of local concern, are found where civilization progresses. These pertain to the supply of water for domestic and municipal use. The quantity is almost insignificant in comparison with those required for navigation, water power, or irrigation. But while the quantities are small the quality is of great importance, for upon it depends the life and health of the masses of the people in the cities. As a rule each city or town makes its own investigations regarding the source of supply and the amounts obtainable from watersheds. The time is approaching when vigorous steps must be taken to prevent stream pollution, and in the mean time a thorough knowledge must be obtained of all possible sources of supply.

THE GEOLOGY AND TOPOGRAPHY OF THE DRAINAGE BASIN.

The drainage area of the South Palouse River, from Pullman to its head, lies almost wholly in the Palouse wheat raising section. About nine-tenths of the area is under cultivation of which about one-half is summer fallowed each year, the other half is covered with a rich growth of grain during the summer months. The whole area is treeless with the exception of a few willows along the creeks and about 12 square miles of timber in the extreme northeastern part, lying along the Thatuna Hills.

The whole area is a rolling basaltic plateau, bordered on the northeast and the southeast by a low range of foot hills, the area has a general slope toward the southwest, the South Palouse flows very nearly through the center of it. The principal branch of the South Palouse, Paradise Creek, which flows nearly parallel to it, drains the northern portion and joins it near Pullman. The stream heads in the Thatuna Hills and flows southwestward in shallow channels at first, which increase progressively in depth until at Pullman they are nearly 200 feet in depth.

The deep, rich soil covering the area is a residual soil formed by the disintegration and decay of the underlying lavas. The only basalt seen are the outcroppings along the channels of the streams, and in the stream bottoms. At a depth usually of 5 to 8 feet below the surface the dark color of the upper soil fades